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AUTHOR Neuwirth, Christine M.; And Others
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ABSTRACT

This paper discusses "Comments," a computer tool developed to study computer support for response to writing. The paper presents two primary theoretical perspectives to support the use of response to writing in learning to write: (1) writing is a social act; and (2) writing is a skill whose acquisition requires more than one reader so that writers must grapple with different readings. The "Comments" program, as implemented with five classes of highly motivated, high ability freshmen students for three semesters at Carnegie Mellon University (Pennsylvania), is described in terms of intended audience, contribution to student needs, use of computers as compared to pen and paper technology, and software features. The impact of the "Comments" program is discussed with respect to using statistics, skill acquisition, student attitudes, and patterns of interaction. Four figures representing the "Comments" program and 20 references are attached. (NH)

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The Comments Program:

Computer Support for Response to Writing

Christine M. Neuwirth, David S. Kaufer, Gary Keim and Terilyn Gillespie

Center for Educational Computing in English
English Department
Carnegie Mellon University
Pittsburgh, PA 15213

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Goals

Comments is computer tool developed in order to study computer support for response to writing. Writers and readers can use the Comments program to "talk" about a piece of writing over our campus-wide network of advanced-function workstations. The program is intended to make it easier for students to perform the following tasks:

- share their w ork in progress with other members of the class, friends, and their teachers
- ask for clarification of written comments
- share plans for revision based on written comments
- communicate about whether a draft has addressed previous comments

Theory

There are two primary theoretical perspectives that support the use of response to writing in learning to write. The first emphasizes writing as a social act (Bruffee, 1973, 1985; Gere, 1987). By interacting with each other, teachers and students can engage in a dialogic/dialectic that stimulates invention (LeFevre, 1987). A dialogic activity engages writers in a conversation with readers and other writers, primarily to become aware of views other than their own. A dialectic activity engages writers and readers in a search for agreement. Such a search can sometimes lead a writer to reassess the validity of his or her own point of view. Both dialogic and dialectic responses can provide powerful motivation for a writer to elaborate or justify his or her opinions.

The second perspective emphasizes that writing is a skill whose acquisition requires knowledge of outcomes, and that knowledge of outcomes is best given by a group of readers (students and teacher) rather than only one reader (the teacher). More than one reader more closely simulates actual communicative situations in which writers must grapple with conflicting readings. In a meta-analysis of pre-test to post-test effect sizes, Hillocks (1986) concludes that a "combination of peer and teacher feedback is consistently somewhat stronger than only teacher feedback..."

The Comments program is intended to support both these theoretical perspectives by

providing a communication-support system for writers and readers, students and teachers.

Difficulty

Despite the strong theoretical reasons for believing that response to writing is helpful, research results are somewhat mixed (DiPardo and Freedman, 1987; Freedman, et al., 1986). Detailed observational case studies (Berkenkotter, 1984; Ziv, 1984) offer compelling evidence that students' failures to benefit from peer and teacher feedback often stem from failures to communicate effectively about that feedback. For example, many students who fail to understand a comment on their writing do not see it as an opportunity to communicate with their teachers or peer group; rather, they reject the comment out of hand or--also not uncommonly--accept it despite an unresolved misunderstanding/disagreement.

Obviously, students' views of comments will affect how they read them. Students often don't understand their teachers' comments (Butler, 1980; Hahn, 1981; Schwartz, 1983). Students often think that teachers' comments reflect teachers' confused readings rather than their own confused writings and so discount the value of the comments (Hahn, 1981). Students are frustrated by what they perceive as a lack of consistency in comments (Summers, 1982) or when teachers' and peers' comments contradict each other (Ziv, 1984).

Because of the theoretical perspective and research findings outlined, in developing tools and methodologies for computer-based support for response to writing we have concentrated on developing ways to facilitate communication. For example, the Comments program is designed to be primarily a communication support system. The program exploits the campus-wide personal computer network to enable students and teachers to "talk" more easily about each others' responses to writing. This design decision assumes that students' confusions and difficulties are an inherent part of the communication process. By providing a system that facilitates communication, we hope to provide a system that encourages students to represent the act of reading comments

as an interpretive act, on a par with the interpretations required in reading any text.

Intended Audience

Our immediate audience was students in our Freshman writing courses at Carnegie Mellon. These students are highly motivated, high ability students. The writing course is required of all incoming Freshmen in all colleges: engineering, science, fine arts (e.g., drama, painting), humanities and social sciences. The students do not typically require much instruction in grammar or mechanics; the Freshman writing courses focus on the processes of writing and strategies for producing particular types of writing. Students write two or three substantial papers (10-20 pages). All writing courses that fulfill the Freshmen writing requirement require multiple drafts with between-draft response.

All entering CMU students take a Computing Skills Workshop that teaches three computer systems, including Andrew, the system on which Comments is implemented. Thus, our documentation assumes that students are familiar with computers generally and with Andrew in particular.

As a tool, the Comments program will not benefit students who lack the knowledge, ability or motivation to use it appropriately. We believe that students need instructional support in addition to the tool in order to use the tool to learn effectively. For example, members of CECE (Center for Educational Computing in English) meet on a weekly basis with instructors using the Comments program to discuss theories of response to writing, ways the Comments program can implement those theories, and ways of communicating with students about the role of response in learning to write and the social/cognitive skills that students/teachers need to exercise in order to interact supportively. We consider it inappropriate to consider the effectiveness of the tool apart from instructional strategies which attempt to exploit and amplify its advantages.

Contributions to Students

We hope that the Comments program meets the following student needs:

--Need for timely response. Teachers and students using the Comments program report that they are able to give more timely response. For example, some teachers encourage students to submit a draft when the student needs a response. These teachers typically do not respond to every aspect of a student's draft; rather they report taking a few minutes to skim a paper that a student submits, focusing their response on some aspect of the student's draft, then returning the draft.

--Need for sharing work quickly and easily. Students submit drafts to other students and their teacher when they most want feedback. Students do not need to wait until class to exchange papers easily. They do not need to hunt for physical mailboxes, something few students are willing to do, especially for off-campus addresses.

--Need to make sense of unclear, inconsistent, or other problematic comments. When students encounter problematic responses, students can easily send the paper on to another reader; or they can use the dialog capabilities of the program to ask the first reader for a clarification.

--Need to know whether the next draft has addressed comments. Students can submit a revision with comments and "discuss" the revisions using the Comments program.

Use of Computers

Pen and paper technology has several drawbacks that computer technology potentially can overcome. First, marginal comments, because of lack of space, are often mere phrases, short questions or brief statements. Rarely are they longer than one or two sentences. Often they do not indicate the exact location of a problem because doing so would interfere with the legibility of the student's original text. They are often barely legible. Terminal comments, on the other hand, do not indicate the exact location of a

problem, though they can be longer. Although it is possible to adopt a system that combines the advantages of both (e.g., some teachers put an endnote number at the location of each feature in the text and write more detailed comments at the end), computer technology facilitates the bookkeeping involved in such a combination system (e.g., if a teacher numbers an end-note 1 and, at a later point, another 2, the teacher is forced to number as 1.a, 1.b, etc. any comments added later that fall between 1 and 2; however, the computer can keep track of numbering automatically. Indeed, the Comments program does this when printing comments).

Some students report feeling as though the integrity of their paper is reduced when handwritten comments appear throughout the entire text. Computer technology can help preserve integrity, by allowing commenters to place a small, relatively unobtrusive icon within the text to represent an area of interest. Connected to this icon is the comment, which is composed and viewed in a separate panel, beneath the entire text of the paper. This comment region provides unlimited space for a reader to record his or her thoughts, allowing for more detailed comments than in typical pen & paper situations. Because computers do not collapse the storage and display of information, the icons can be hidden altogether, allowing the student see the text 'as-if' there were no comments whatsoever.

Computers can potentially support the multiple purposes teachers have in responding to students' papers. Teachers have at least four ways of thinking about comments on student papers (Purves, 1984): (1) the diagnosis of students' writing problems, either problems with the product or process problems inferred from the product; (2) teacher-assisted revision, in which the teacher helps the student revise by detecting error, diagnosing error, or correcting the error; (3) reader-response in which the teachers' comments emulate questions that a colleague/reader might have about the text; and (4) the justification of an evaluation, typically a grade.

In pen & paper technology, it is usually not possible for teachers to fulfill all these goals simultaneously without the labor and expense of xeroxed copies. For example, in

diagnosing a problem, teachers often use comments to write down hypotheses about what the problem is, how the student should fix it, etc., only to change course later on and decide that another hypothesis is warranted. Because teachers typically write these intermediate hypotheses on their only copy of the text, students often see these, or the scratched out remnants of them. Likewise, in justifying an evaluation, teachers often wish to make comments that correspond to the entire set of evaluative criteria. In contrast, in teacher-assisted revision, the teacher typically wants to establish an agenda for instruction--to pick out some subset from the manifold possibilities in order to focus the student's concerted attention. Although not the focus of our research interest, electronic copies potentially facilitate the management of the multiple function of comments.

As noted in previous sections, we believe one of the primary advantages of computer technology over pen and paper technology will be its capability to facilitate students and teachers working together to respond to writing. A campus-wide network frees students from often frustrating activities of scheduling meetings with their instructors or peers to discuss a paper. We do not mean to imply that students and instructors should not meet face-to-face--either in class or outside. Simply that the computer technology provides an additional mode of communication--one that our users seem to judge to be a welcome middle ground between face-to-face meetings and hard copy written comments.

We hypothesize that the increased ease and efficiency of arranging to "talk" about papers results in more communication between student writers and readers; in turn, more communication may produce more effective writing by students. The ability to comment on a comment also encourages communication, as students are able to respond immediately to comments they have received, by requesting further clarification or expressing their disagreement. This ability to discuss comments may in turn yield greater understanding by students, as well as an increase their knowledge base.

Pen and paper retains some advantages over computer technology. For example,

people report a difficult time "getting a sense" of texts that are displayed online, even on large-screen (19x19), high resolution bit-mapped displays (Haas & Hayes, 1986). For this reason, we recommend to students and teachers that they do not try to use the Comments program to replace hard copy, but to use it in a way that exploits the advantages of the various modes of communication (i.e., face-to-face, hard copy, computer-based comments, etc.).

Software Features

Integration with the campus-wide network

As noted earlier, the Comments program is integrated with our campus-wide local area network. A computer network is a system of independent computers (today, typically personal computers or workstations) that communicate with one another and allow users to share computer resources such as hardware (e.g., laser printers), programs (e.g., large statistical packages), or files (e.g., essays). Our campus' local area network allows students and teachers to access their files from any workstation on campus. For example, if a teacher sends a message to a student, the student can go to any public workstation on campus and read the message.

Figure 1 depicts the Comments start-up screen, which displays the major network communication options: Send a paper and Read a paper. Other options include Retrieving a Paper (which retrieves a paper, typically from someone who has failed to return it); Delete Comments (which deletes the comments on a paper, typically when the user is done with a draft); Help (the online help), etc.

Sending a paper

When a user chooses to send a paper, the Comments program uses the campus-wide network to send the paper to the people who will be responding. Users can send their own papers, or they can send along another person's paper, analogous to passing along a hard copy paper to the next person on a distribution list. There is no limit to the

number of users who can be sent a paper (the students and teachers, however, have organized into groups of two to five). The recipients of the paper are notified by electronic mail messages that the user would like them to comment on a paper.

Making comments

To comment on a paper, the user chooses Read a Paper and types in the name of the person whose paper he or she wants to read. Normally, the commenter can read the paper, but cannot change it except to add comments (N.B. The comments are stored separately and do not actually change the file containing the paper).

The user can make comments that are tied to specific regions of text or that apply to a location in the text (e.g., a global comment at the beginning of a paper). To make a comment, the user points to a location in the text or selects a region of text, opens a menu and chooses Make Comment from the pop-up menu (see Figure 2).

Composing a comment

When the user chooses Make Comment, a comment region appears below the text. The text itself is recentered, if necessary, so that the selected region for the comment remains visible on the screen. An icon appears in the text. The icon looks like a triangle and indicates that there is a link between the text and the comment (see Figure 3).

To compose a comment, the user moves the mouse cursor inside the comment region, clicks the left mouse button and begins composing. The Comments program uses the Andrew system base editor, so the user has the full functionality of an integrated text-editor/document-formatter to compose. In addition, the user can copy material from other texts in other windows and paste it into the comment or the user can insert text that is stored in files.

Although the comment region approximates a 3 X 5 card, the text of the comment can

be as long as the user desires. If the text that the user composes exceeds the space allocated to a comment region, the entire text will not be visible. However, the user can scroll the text to view different parts of it or enlarge the Comments program window so that more text is visible.

Multiple comments and comments-on-comments

To make another comment, the user selects a region of text and chooses Make Comment again. The previous comment is replaced by a blank comment region. The user can make as many comments as desired. The user can comment on other comments (perhaps comments made by the author or other readers), by pointing to a location within the comment and choosing Make Comment. Figure 4 depicts a screen showing comments on comments. This is the facility that allows writers and readers to "talk" about a text.

The user can make comments at different sessions at the workstation. When the user is done commenting, choosing Send a Paper allows the user to return the paper to the author or pass it along to another person for comments. The author or other person is again notified via electronic mail.

Viewing comments

The program provides four options for viewing comments. The user can find the next comment in a text by choosing Next Comment from the pop-up menus; the user can find the next new comment (i.e., a comment that he or she has not seen before) by choosing Next New Comment; the user can scan the text for comment icons and point and click on one of the icons to view a comment; finally, the user can point and click on one of the comments in the comment chain, represented on the right of the screen (see Figure 4). The comment chain represents a chain of comments on comments.

Revising with comments

The author of the paper can revise it from within the Comments program. There are options for deleting comments as well as text. The user has the full functionality of an integrated text-editor/document formatter.

Establishing a dialog

If the author does not understand or disagrees with a comment, the author can choose Make Comment, ask for elaboration, then choose Send a Paper to send the paper back, continuing a dialog with his or her readers.

Implementation

The Comments program runs on advanced function workstations--IBM RTs, SUN2s & 3s, and VAXstations. It runs under Andrew, a window-management and base environment for UNIX 4.2 BSD (Morris, 1986). It is also dependent on the Andrew ITC file system.

Type of Software

We wanted to design a tool that allows teachers and students to worktogether in writing papers. We assume that the tool will be used in conjunction with classroom teaching.

While it would be possible to build a tutorial that instructs students in how to respond to writing or how to revise particular problems in texts (e.g., how to detect, diagnose and correct topic shifts), it was not our research focus.

Development

We evaluated the Comments program interface by a task analysis and informal user testing (Keim & Greene, 1987). We have also interviewed our teacher and student users about their use of the program. The Comments program has a menu option that allows users to report problems to us, and we also maintain a campus-wide bulletin boards where users can discuss reactions, problems, etc.

Impact

We have operated Comments in about 5 sections of Freshmen English courses for three semesters. (We have not expanded its use because demand for Andrew workstations, the system on which Comments is implemented, far exceeds the supply.) Two of the sections are typically Strategies for Writing, the introductory writing course that all but advanced placement students take; one section is usually Reading Texts, a literature course designed to teach students strategies of interpretation and response; two sections are typically Reading & Writing Arguments, a writing course designed to teach students how to write original essays on an argumentative issue. The program has also been used with junior and senior engineers in a professional/business writing course. Although not part of our original target audience, several units within the University have reported using the program. The Comments program has also been announced in the ICEC catalog as available to schools belonging to the Inter-university Consortium for Educational Computing, but it would need considerable work to set up for a network other than the Andrew File System.

Use statistics

When we first released the Comments program, there were 83 potential users, 4 teachers and 79 students. We did not require its use; we simply announced its availability. We tracked its use for the remaining weeks in the semester. The program averaged 83 uses (start-ups)/week (35 S.D). Not all users used the program every week. The average number of users/week was 33 (11.4 S.D.). We speculate that its use fluctuated with writing assignments.

Impact on skill acquisition

MacNealey (in prep.), reports that students working with the Comments program succeed in fixing more grammatical errors than students working with a traditional hard copy handbook. Although further research is required, this result may be due to the greater diagnostic specificity that the Comments program facilitates.

Student attitudes

After being required to use the program to make comments, we measured ten students' attitudes toward the program by using a set of 7 point scales (For example, 1 = Extremely unhelpful, 2 = Very unhelpful, 3= Slightly unhelpful, 4 = Neutral, 5 = Slightly helpful, 6 = Very helpful, 7 = Extremely helpful). The scales were based on a set used by Good (1981).

As seen in Table 1, students were neutral to slightly positive on all dimensions except the items measuring their perceptions of the program's speed, which they rated slightly negative, and familiarity, also slightly negative.

We also asked students to rate the Andrew text-editor, EZ, a "what-you-see-is-what-you-get" integrated text-editor/document formatter that has undergone a good deal of interface testing. Students rated the EZ text-editor as significantly more familiar than the Comments program ($p < .01$). Since students are trained on EZ in the Computing Skills Workshop but not on Comments, this result is not too surprising. Students also rated EZ significantly more easy ($p < .05$) and pleasant ($p < .05$) than Comments. We were already aware of some ease-of-use problems based on our interviews with users, so we had revised the interface for Comments to simplify the network transactions. The interface described in this report reflects that revision; the student attitudes reflect the old interface. We will be collecting new data to see whether we have improved it.

Patterns of interaction

As noted earlier, we interviewed students and teachers about their use of the program. Some of them reported that the program has altered their patterns of interaction. Some teachers encourage more frequent submission of drafts; although they still maintain a draft due-date,students are encouraged to submit more often with specific questions. Students were enthusiastic about the increased frequency of interaction as well as not having to wait until class or office hours to ask a quick question. We are currently

conducting a study that is looking at possible effects of the network tools, including the Comments program. Based on interview data with teachers and students, we are focusing on possible changes in patterns of interaction and any effects on quality of writing. In collaboration with members of the Social and Decision Sciences department,we are studying two sections of writing that are using network tools; two contrast sections.

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System programming: Rick Chimera, Gary Keim, Dale Miller, Keith Evans, Aaron Oppenheimer

User testing: Stephan Greene, Gary Keim, Terilyn Gillespie

Documentation: Chris Neuwirth, Terilyn Gillespie

System design consultant: Thom Peters

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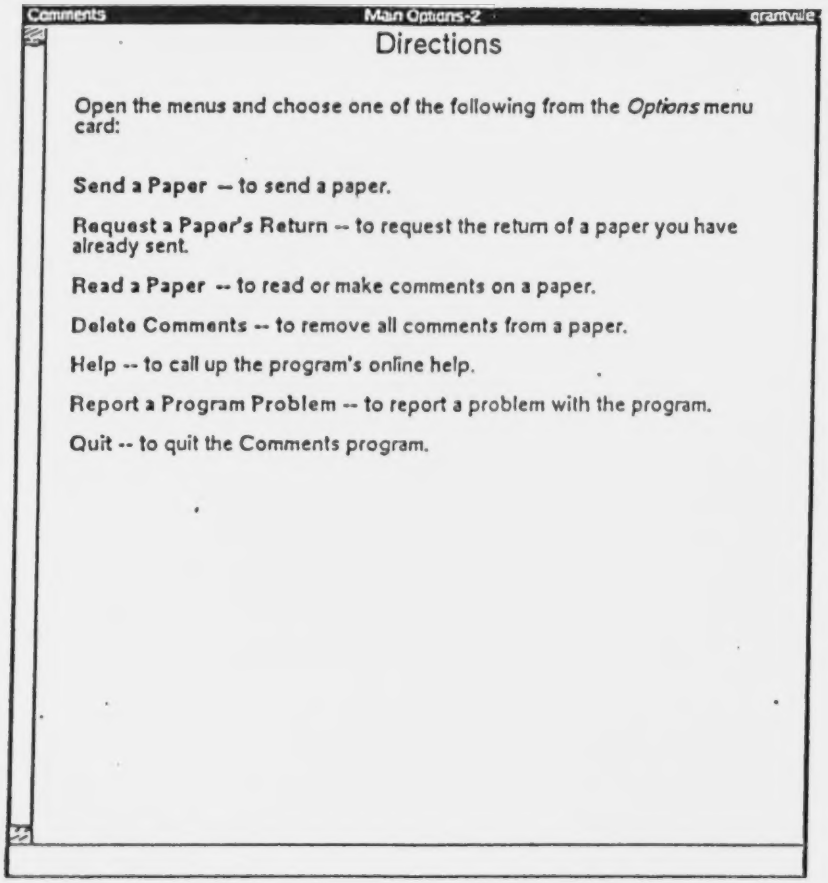

Comments
Main Options-2
grantville
Directions
Open the menus and choose one of the following from the *Options* menu card:
Send a Paper -- to send a paper.
Request a Paper's Return -- to request the return of a paper you have already sent.
Read a Paper -- to read or make comments on a paper.
Delete Comments -- to remove all comments from a paper.
Help -- to call up the program's online help.
Report a Program Problem -- to report a problem with the program.
Quit -- to quit the Comments program.

Figure 1. The Comments Program Options

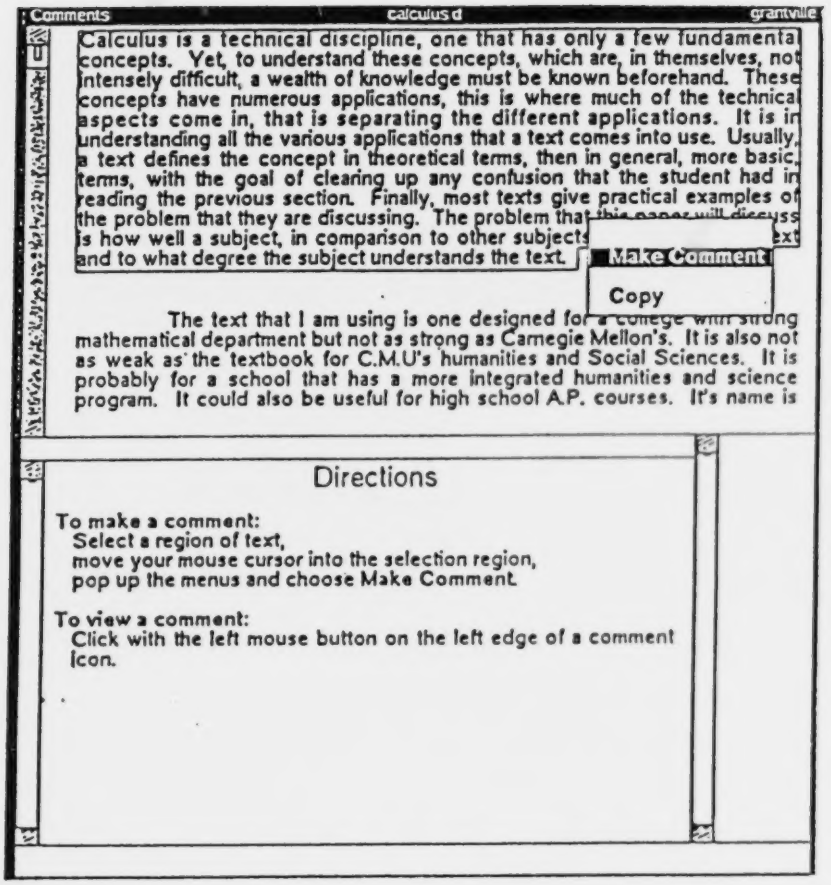
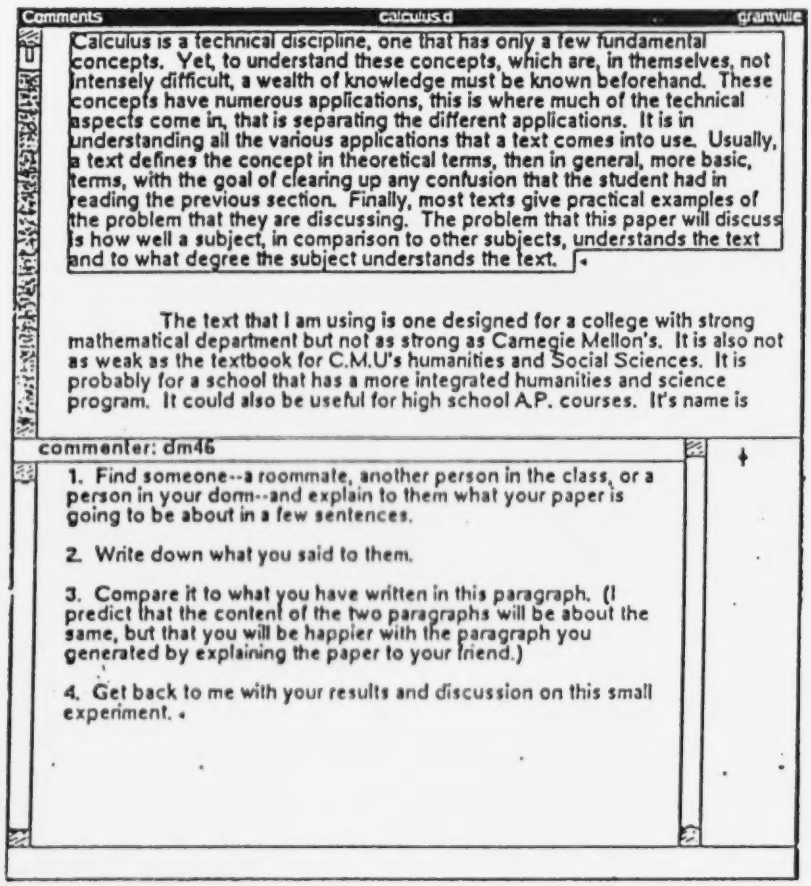

Comments
calculus d
grantville
Calculus is a technical discipline, one that has only a few fundamental concepts. Yet, to understand these concepts, which are, in themselves, not intensely difficult, a wealth of knowledge must be known beforehand. These concepts have numerous applications, this is where much of the technical aspects come in, that is separating the different applications. It is in understanding all the various applications that a text comes into use. Usually, a text defines the concept in theoretical terms, then in general, more basic, terms, with the goal of clearing up any confusion that the student had in reading the previous section. Finally, most texts give practical examples of the problem that they are discussing. The problem that this paper will discuss is how well a subject, in comparison to other subjects
ext
and to what degree the subject understands the text.
Make Comment
Copy
The text that I am using is one designed for a college with strong mathematical department but not as strong as Carnegie Mellon's. It is also not as weak as the textbook for C.M.U's humanities and Social Sciences. It is probably for a school that has a more integrated humanities and science program. It could also be useful for high school A.P. courses. It's name is
Directions
To make a comment:
Select a region of text,
move your mouse cursor into the selection region,
pop up the menus and choose Make Comment.
To view a comment:
Click with the left mouse button on the left edge of a comment Icon.

Figure 2. Making a Comment


Comments
calculus:d
granville
Calculus is a technical discipline, one that has only a few fundamental concepts. Yet, to understand these concepts, which are, in themselves, not intensely difficult, a wealth of knowledge must be known beforehand. These concepts have numerous applications, this is where much of the technical aspects come in, that is separating the different applications. It is in understanding all the various applications that a text comes into use. Usually, a text defines the concept in theoretical terms, then in general, more basic, terms, with the goal of clearing up any confusion that the student had in reading the previous section. Finally, most texts give practical examples of the problem that they are discussing. The problem that this paper will discuss is how well a subject, in comparison to other subjects, understands the text and to what degree the subject understands the text.
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commenter: dm46
1. Find someone--a roommate, another person in the class, or a person in your dorm--and explain to them what your paper is going to be about in a few sentences.
2. Write down what you said to them.
3. Compare it to what you have written in this paragraph. (I predict that the content of the two paragraphs will be about the same, but that you will be happier with the paragraph you generated by explaining the paper to your friend.)
4. Get back to me with your results and discussion on this small experiment.

Figure 3. Composing a Comment

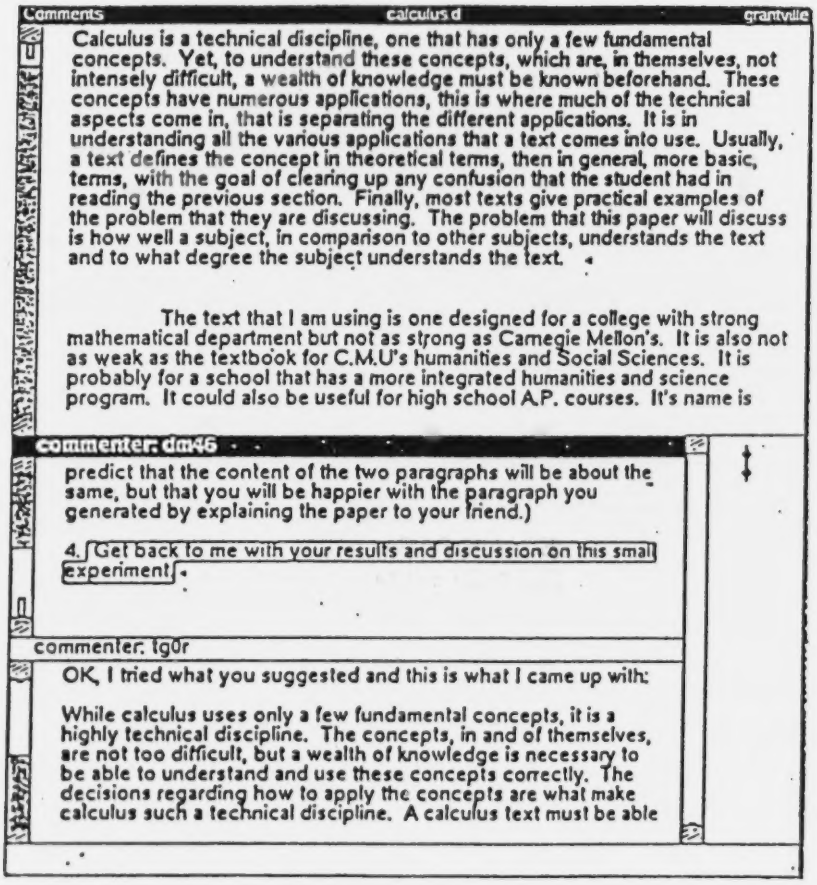
Comments
calculus d
grantville
Calculus is a technical discipline, one that has only a few fundamental concepts. Yet, to understand these concepts, which are, in themselves, not intensely difficult, a wealth of knowledge must be known beforehand. These concepts have numerous applications, this is where much of the technical aspects come in, that is separating the different applications. It is in understanding all the various applications that a text comes into use. Usually, a text defines the concept in theoretical terms, then in general, more basic, terms, with the goal of clearing up any confusion that the student had in reading the previous section. Finally, most texts give practical examples of the problem that they are discussing. The problem that this paper will discuss is how well a subject, in comparison to other subjects, understands the text and to what degree the subject understands the text.
The text that I am using is one designed for a college with strong mathematical department but not as strong as Camegie Mellon's. It is also not as weak as the textbook for C.M.U's humanities and Social Sciences. It is probably for a school that has a more integrated humanities and science program. It could also be useful for high school A.P. courses. It's name is
commenter: dm46
predict that the content of the two paragraphs will be about the same, but that you will be happier with the paragraph you generated by explaining the paper to your friend.)
4. Get back to me with your results and discussion on this small experiment.
commenter: tg0r
OK, I tried what you suggested and this is what I came up with:
While calculus uses only a few fundamental concepts, it is a highly technical discipline. The concepts, in and of themselves, are not too difficult, but a wealth of knowledge is necessary to be able to understand and use these concepts correctly. The decisions regarding how to apply the concepts are what make calculus such a technical discipline. A calculus text must be able

Figure 4. A Dialogue in the Comments Program